National On-Road Mobile and Engine Strategies Impact on Local Areas

(FMVCP, Fuels Programs, Off-road Engines)

by

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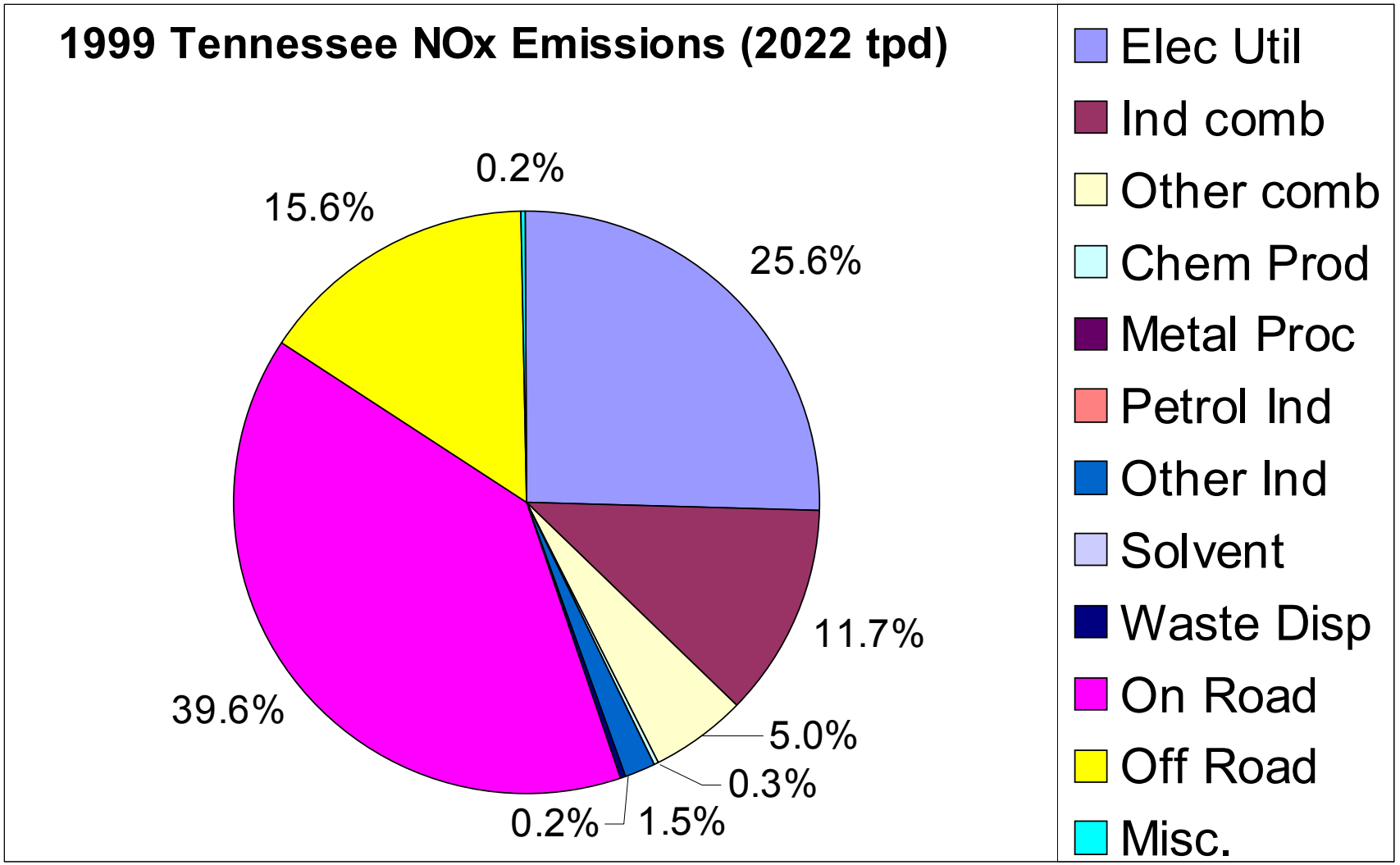
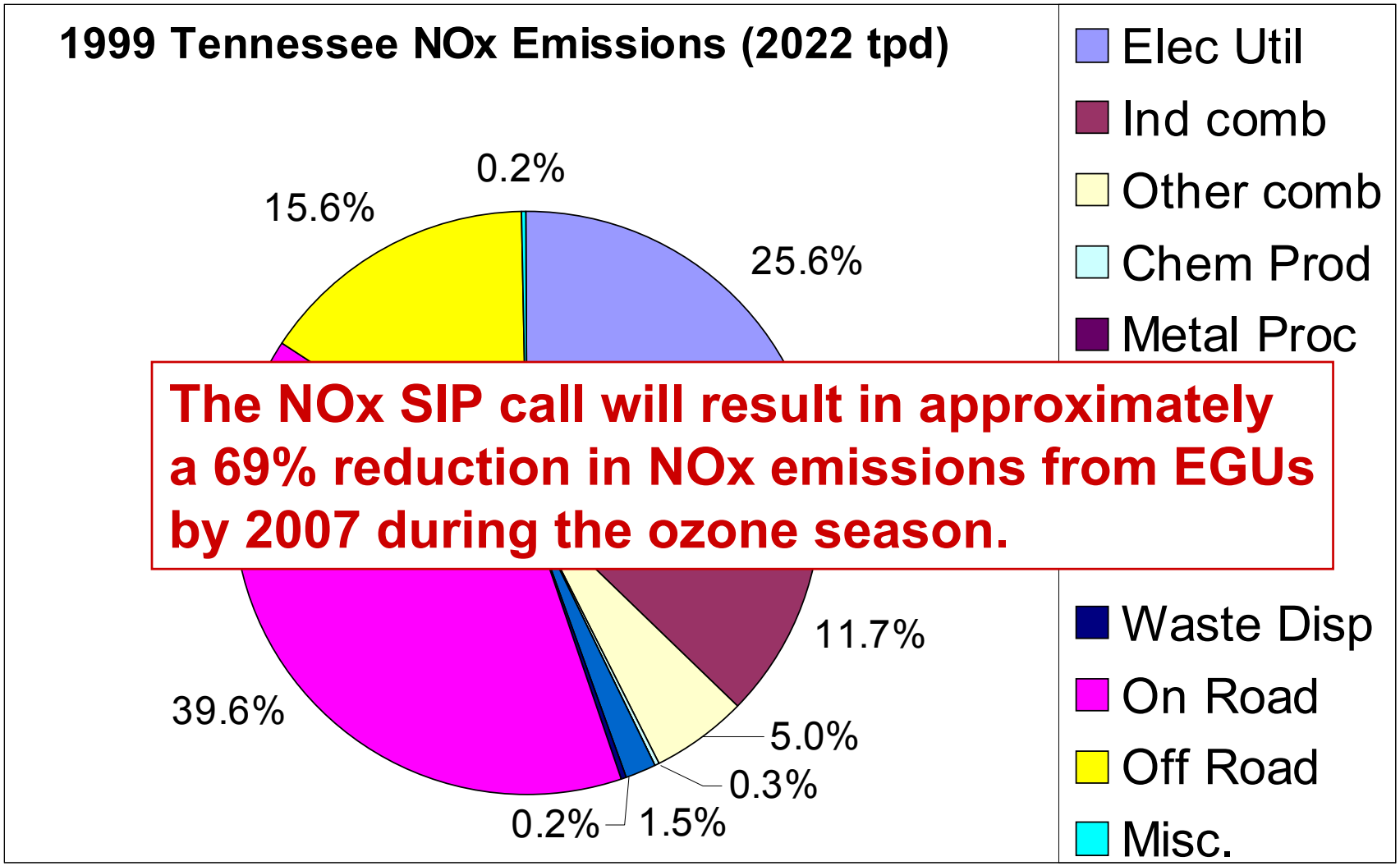
Objectives

- Evaluate the effect of FMVCP, Fuel standards and engine standards on the emissions of ozone precursors
- Demonstrate the effect that these programs have on the emissions of a local area—the Davidson County TN local area. The area is currently a maintenance area for the 1-hr ozone standard and has applied to participate in the Early Action Compact for the 8-hr ozone standard (eight county EAC area)
- Predict county level and EAC level emissions of NOx and VOCs for 1999-2030 to support MPO and State of Tennessee efforts related to the nonattainment modeling for the 8-hr ozone standard and SIP development process

Role of Mobile Sources

- Nitrogen Oxides (NO_x) and Volatile Organic Compounds (VOCs), commonly referred to as ozone precursor pollutants, are photochemically reactive, and thus participate in the formation of ozone
- In 1999, on-road mobile sources were responsible for 34% and 29% of the nationwide anthropogenic emissions of NO_x and VOCs, respectively and nonroad mobile sources were responsible for 22% and 18%, respectively.
- TN specific emissions for NOx are shown in the attached pie chart


1999 Tennessee NOx Emissions (2022 tpd)
0.2%
15.6%
25.6%
11.7%
39.6%
5.0%
0.3%
0.2%
1.5%
Elec Util
Ind comb
Other comb
Chem Prod
Metal Proc
Petrol Ind
Other Ind
Solvent
Waste Disp
On Road
Off Road
Misc.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Misc.
The NOx SIP call will result in approximately a 69% reduction in NOx emissions from EGUs by 2007 during the ozone season.

VMT Growth Rate in US

- Compound growth rate of VMT (1991-1998) in the U.S. was 2.7% with an R^2 of 0.999
- State-level VMT growth rates varied from -0.88% (Washington D.C) to +7.61% (Nevada)
- In the Southeast, growth rates were between 3.5 and 4.5%
- In TN, county growth rates ranged from 0.6% to 6.5%, with Shelby and Davidson at 4.7%, Knox County at 4.2%.

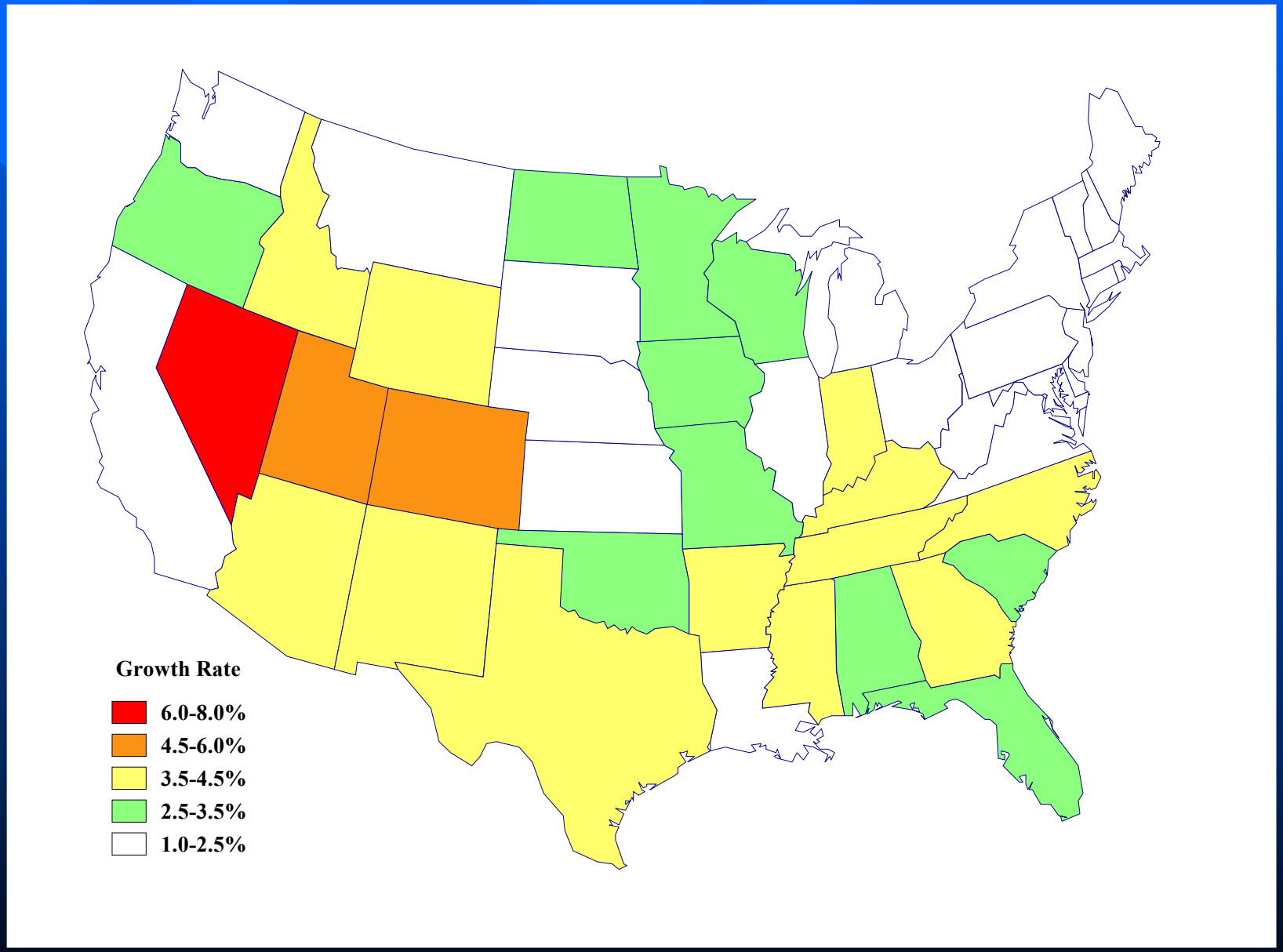


FIGURE 1. Annual Compound Growth Rate of VMT in the United States, 1991-1998.

Regulatory Status – On-road Mobile Sources

- Four regulations being implemented between 2001 and 2007 (also included in the latest MOBILE6 emissions model):
  - **National Low Emission Vehicle (NLEV) Standards for Light Duty Gasoline Vehicles (LDGV) – 2001**
  - **2004 NO_x Standards for Heavy Duty Diesel Vehicle (HDDV)**
  - **Tier2/Sulfur Standards (2004-2006)**
  - **Diesel Fuel Sulfur Standard (2006)**

NLEV Standards for LDGV (2001)

- Patterned after the California LEV program that went into effect in 1997; Replaces Tier 1 Standards (1994-1996)
- Implemented initially in 9 northeastern states that were part of the Ozone Transport Region.
- Fully Implemented in all states for 2001 and thereafter
- The NLEV NO_x emission standard for LDGV is 0.20 g/mile (50% reduction from Tier 1 standard of 0.40 g/mile)
- The NLEV VOC emission standard for LDGV is 0.075 g/mile of non-methane organic gases (70% reduction from Tier 1 standard of 0.25 g/mile)

Tier2/Sulfur Standards (2004-2006)

- Promulgated to help reduce both ozone and particulate matter (PM) levels
- This rule treats both vehicles and fuel as a single system resulting in cleaner vehicles using fuels with lower sulfur content
- Apply to all new passenger cars, light trucks and medium-duty passenger vehicles
- Also decrease emissions from existing vehicles due to improvement in the performance of catalytic converters

Tier2/Sulfur Standards (2004-2006) Cont.

- The Tier 2/Sulfur rule is to further reduce NO_x emissions to an average of 0.07g/mile (compared to the NLEV standards of 0.20 g/mile)
- All refineries will be required to meet the average gasoline sulfur standard of 120ppm and a cap of 300 ppm beginning 2004. By 2006, an average of no more than 30ppm sulfur and a cap of 80 ppm must be met.
- The rule does not have a significant effect on VOC emissions

2004 NO_x Standards for HDDV

- The new rule has a combined emission standard for NO_x and non-methane hydrocarbon (NMHC).
- Manufacturers of such engines have the choice of certifying their new engines to either 2.4g/bhp-hr NMHC plus NO_x standard or 2.5g/bhp-hr NMHC plus NO_x standard with a limit of 0.5g/bhp-hr for NMHC
- This standard is expected to reduce NO_x emissions from HDDV by almost 50%
- Diesel fuel sulfur content to be reduced from 500 to 15 ppm beginning in 2006

TDOT Report

EFFECTS OF GROWTH IN VMT AND NEW MOBILE SOURCE EMISSION STANDARDS ON NO_x AND VOC EMISSIONS IN TENNESSEE 1999-2030

(Based on MOBILE6-Final Version)

March 14, 2002

Emission Estimates (1999-2030)

- Regional (East, Middle, West Tn) meteorology (T_{min}, T_{max}, RH)
- MPO specific RVP, I/M (Memphis and Nashville (5 county area)
- Roadway classification specific vehicle speeds (based on a composite of studies done in the three larger MPOs that currently do conformity analyses)
- County Level VMT by roadway classification
- Area specific vehicle mix based on state registration data, EPA default mileage accumulation rates (AMAR), and TDOT data for heavy duty vehicles

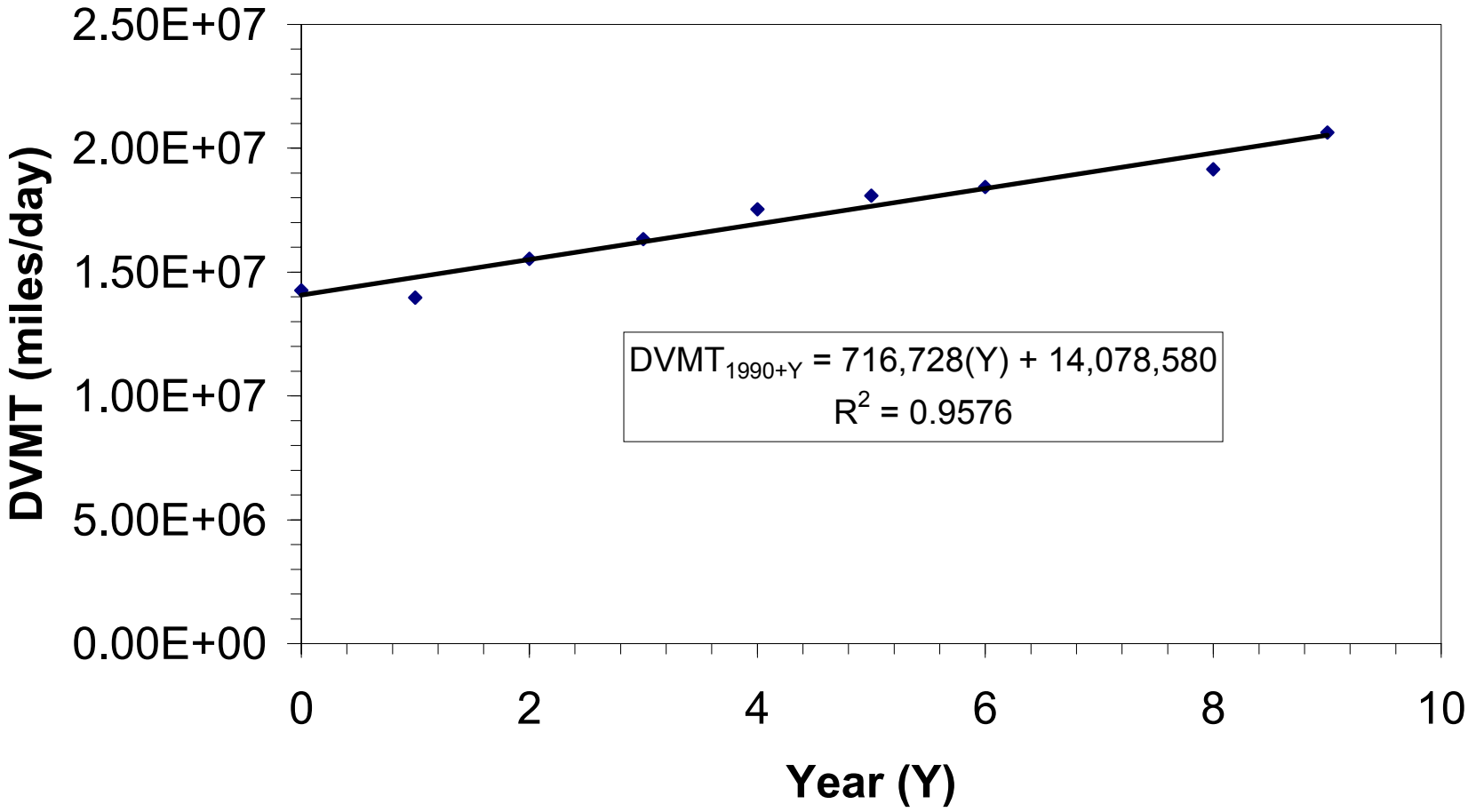
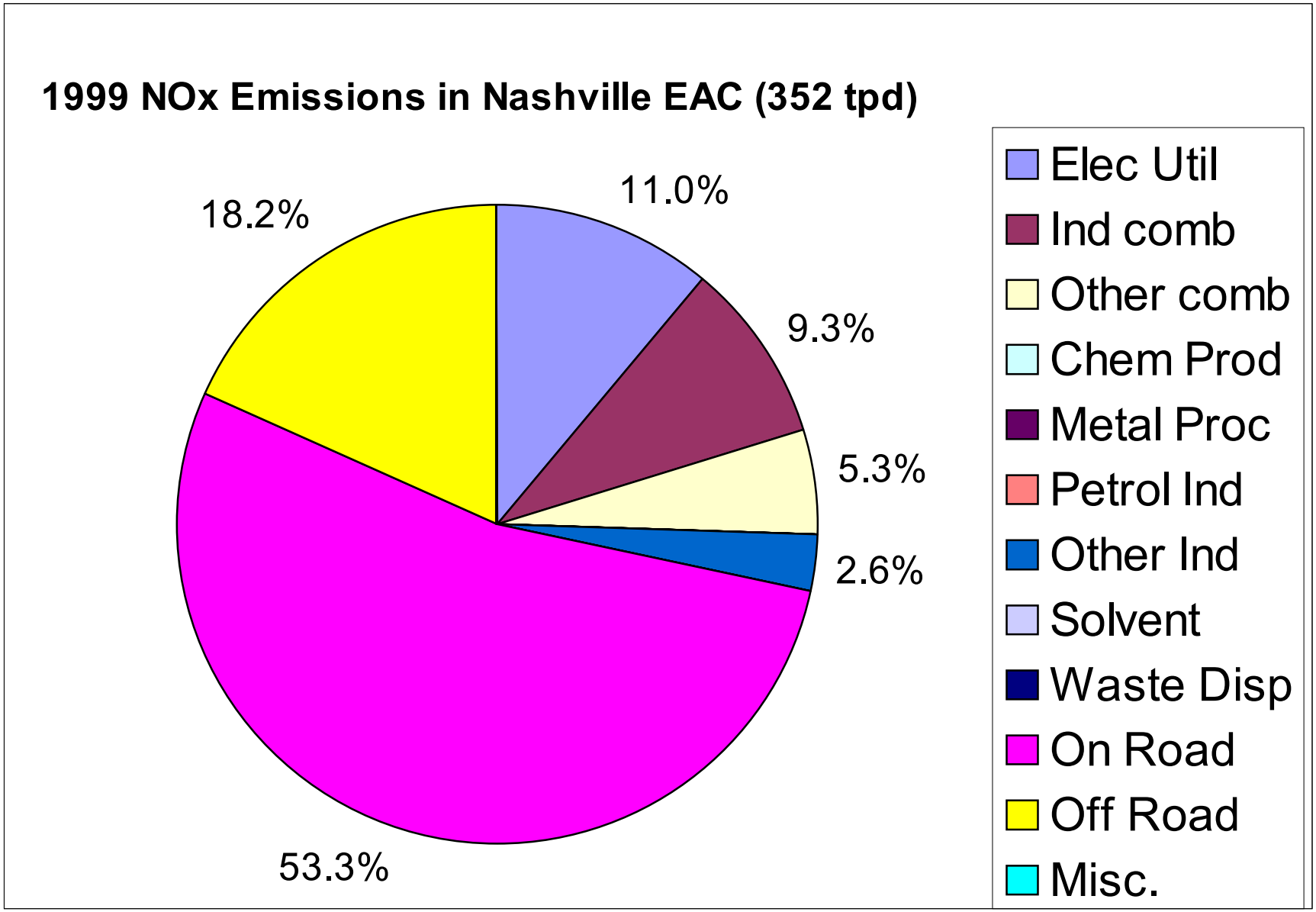


Figure 2-4. Davidson DVMT vs Year (1990-1999)


1999 NOx Emissions in Nashville EAC (352 tpd)
11.0%
9.3%
5.3%
2.6%
53.3%
18.2%
Elec Util
Ind comb
Other comb
Chem Prod
Metal Proc
Petrol Ind
Other Ind
Solvent
Waste Disp
On Road
Off Road
Misc.

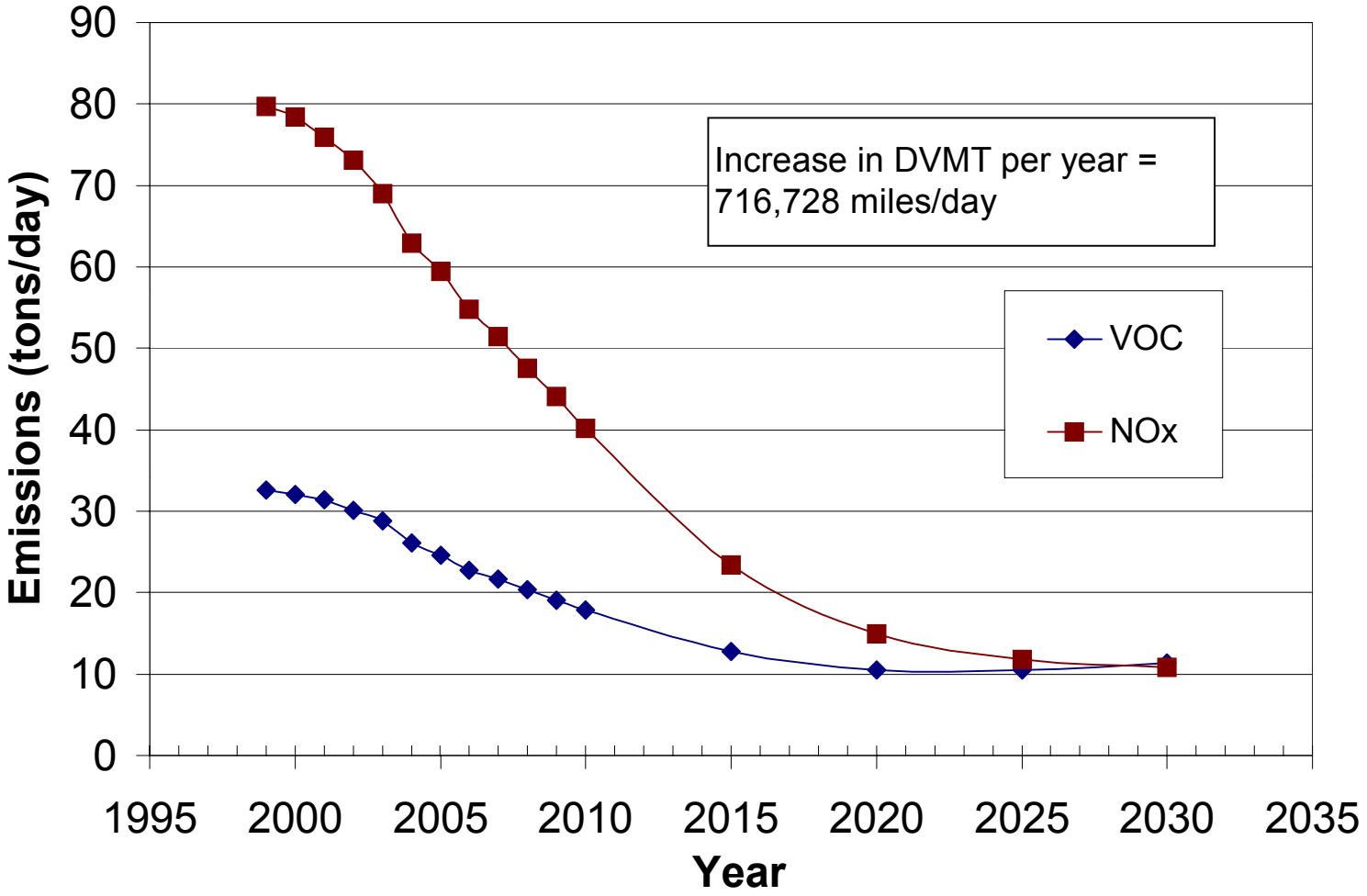
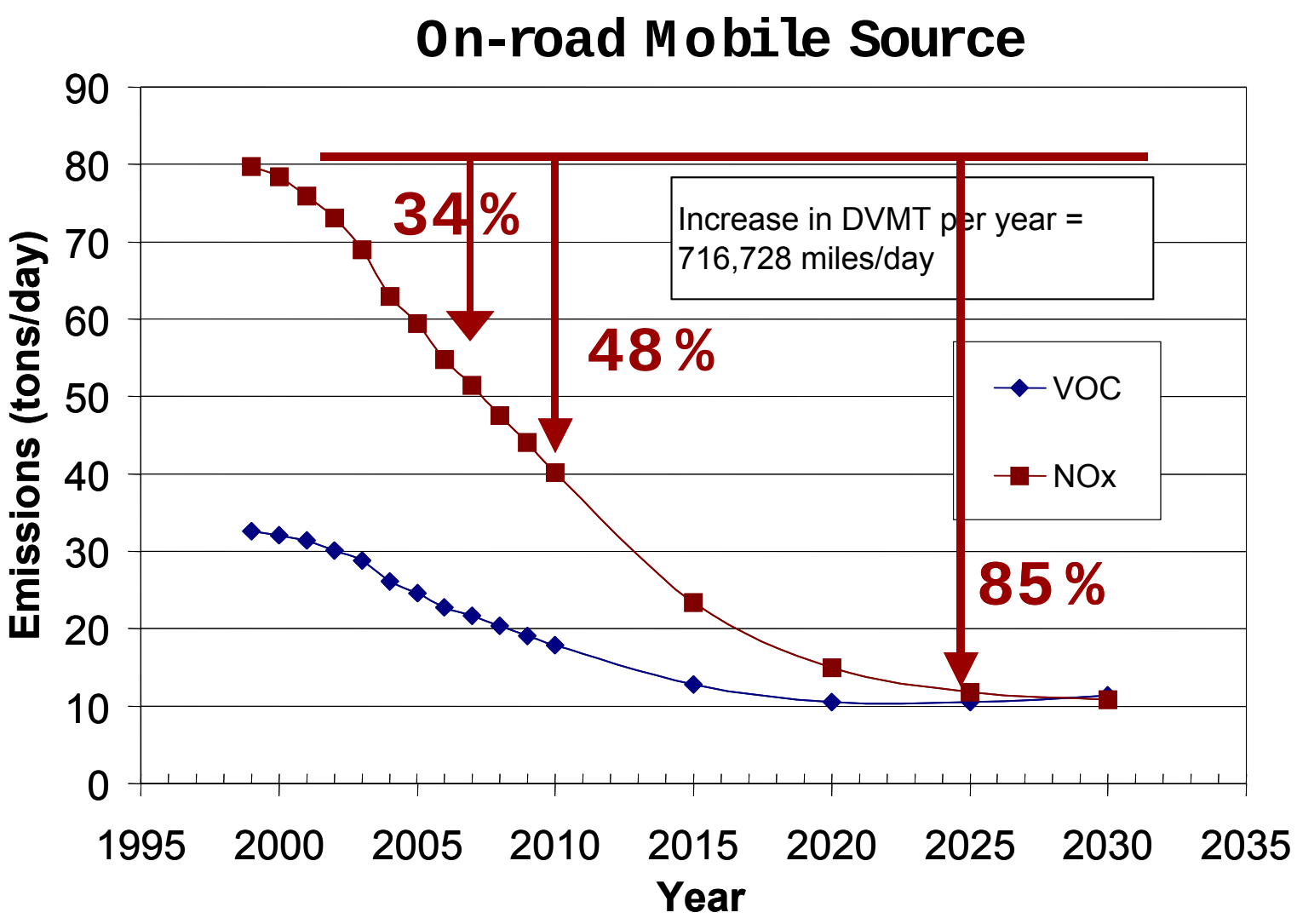


Figure 4-1. Davidson County - Mobile Source Emissions (MOBILE6)



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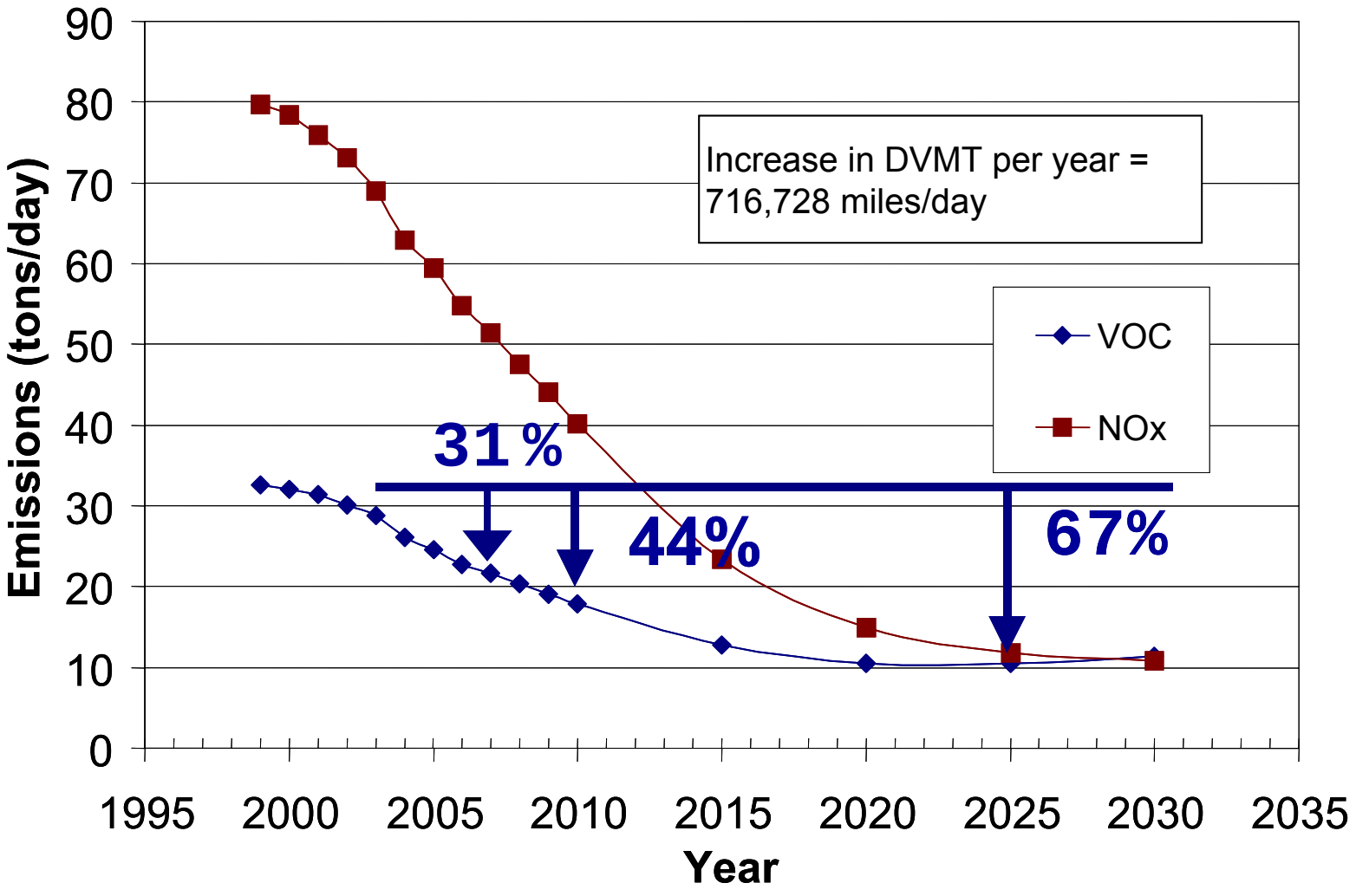
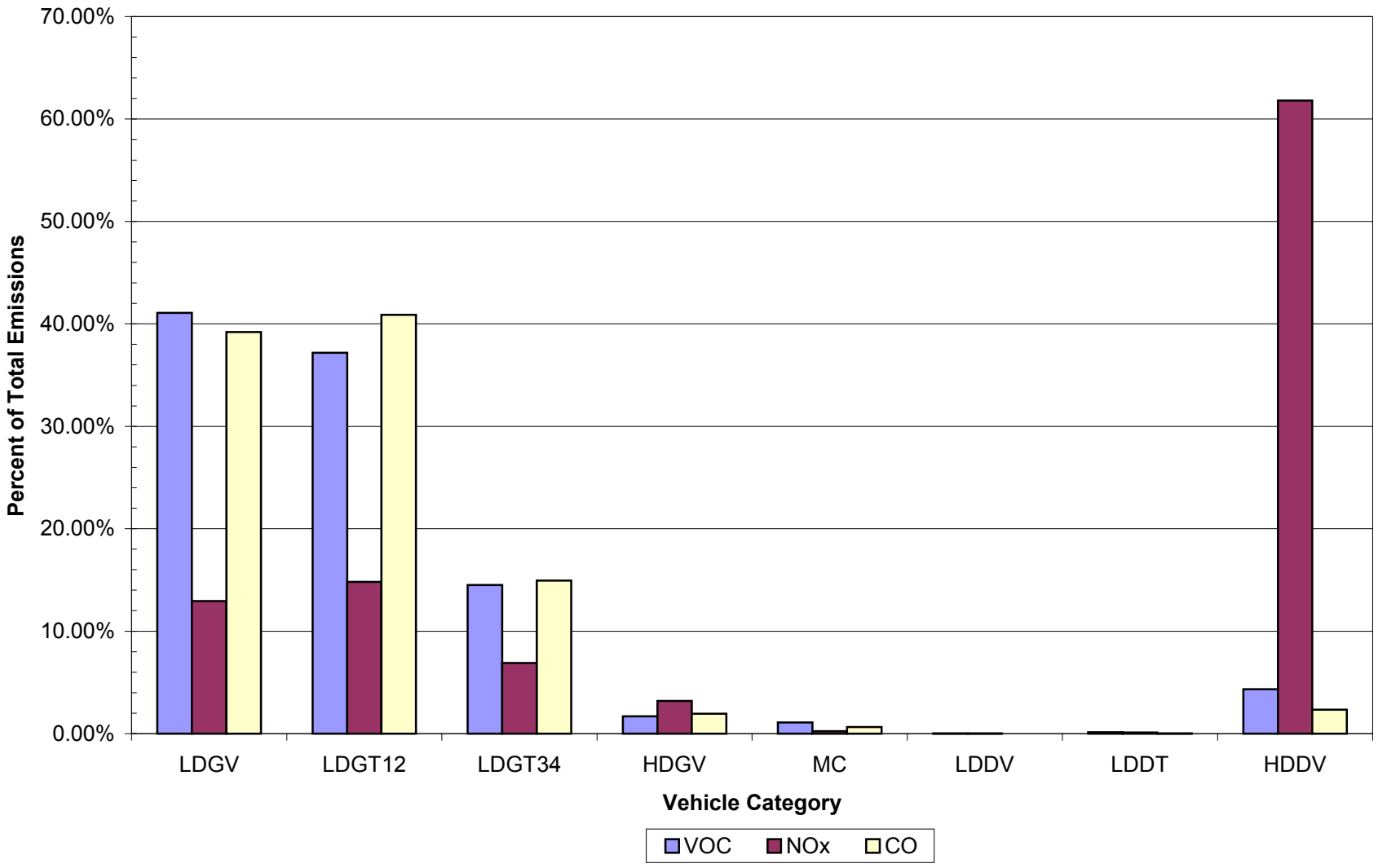


Figure 4-1. Davidson County - Mobile Source Emissions (MOBILE6)

Nashville EAC Area
2007 Emissions Contribution by Each Vehicle Type



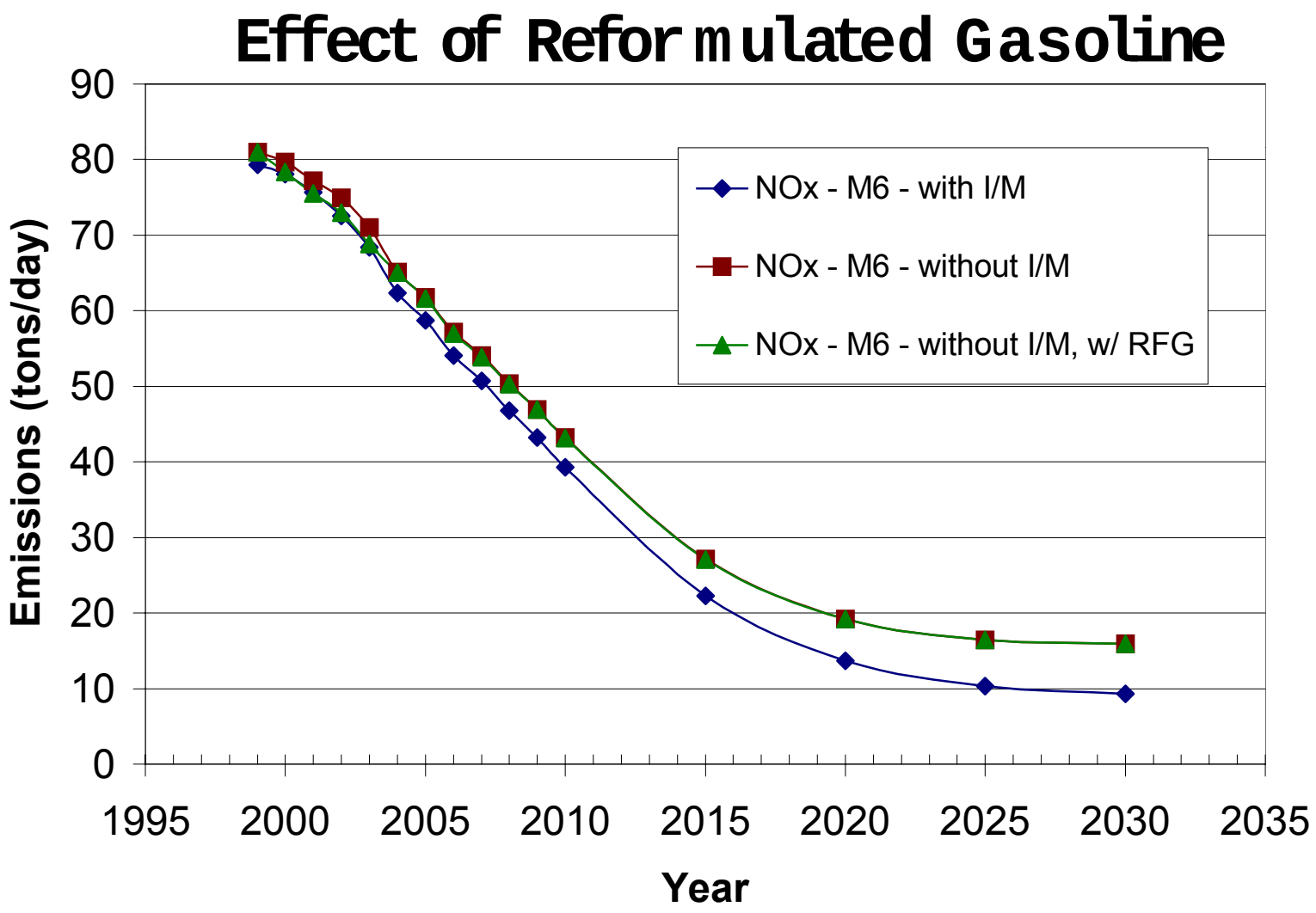


Figure 4-7. Davidson County - NO_x Emissions with and without I/M Program

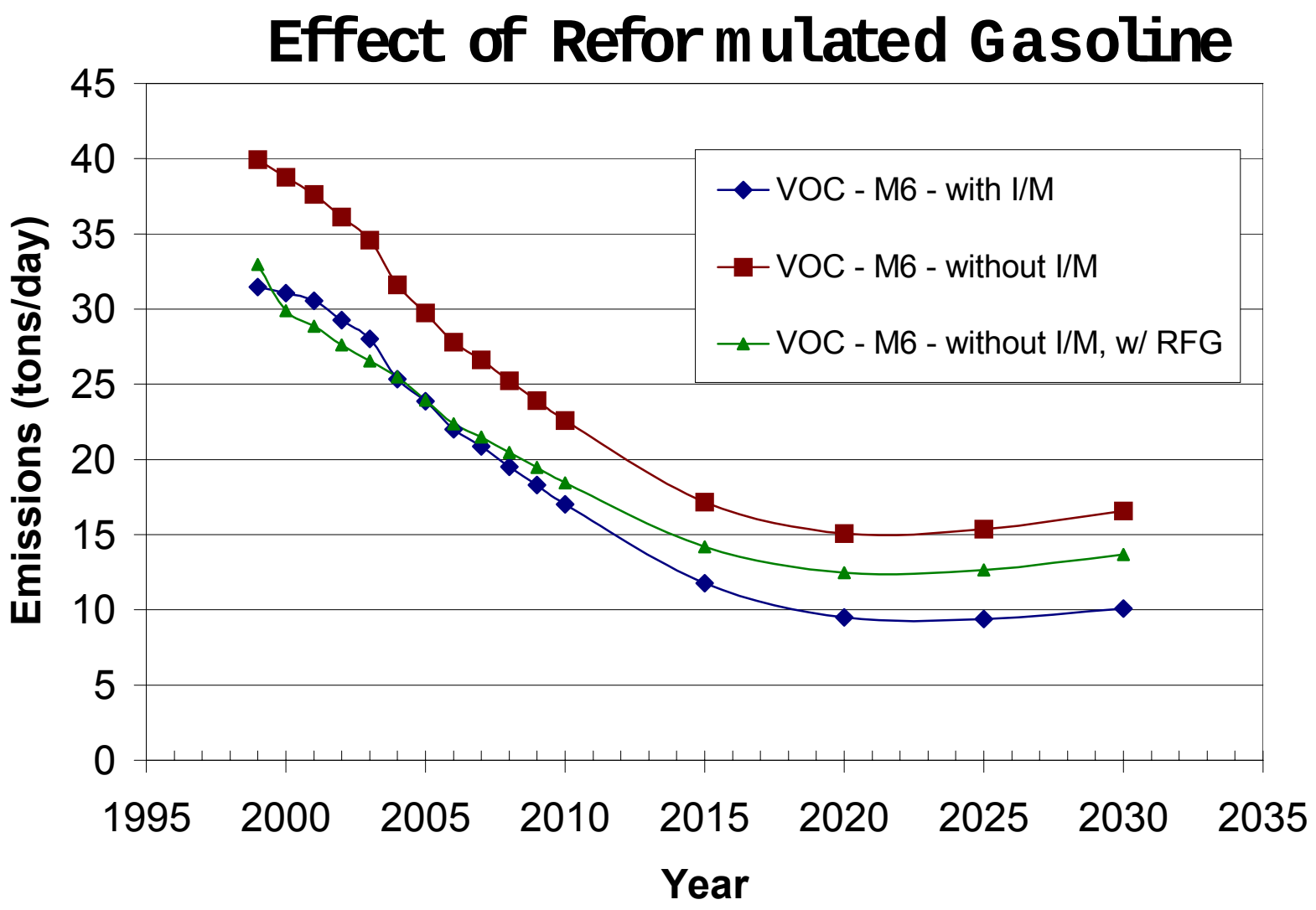


Figure 4-8. Davidson County - VOC Emissions with and without I/M Program

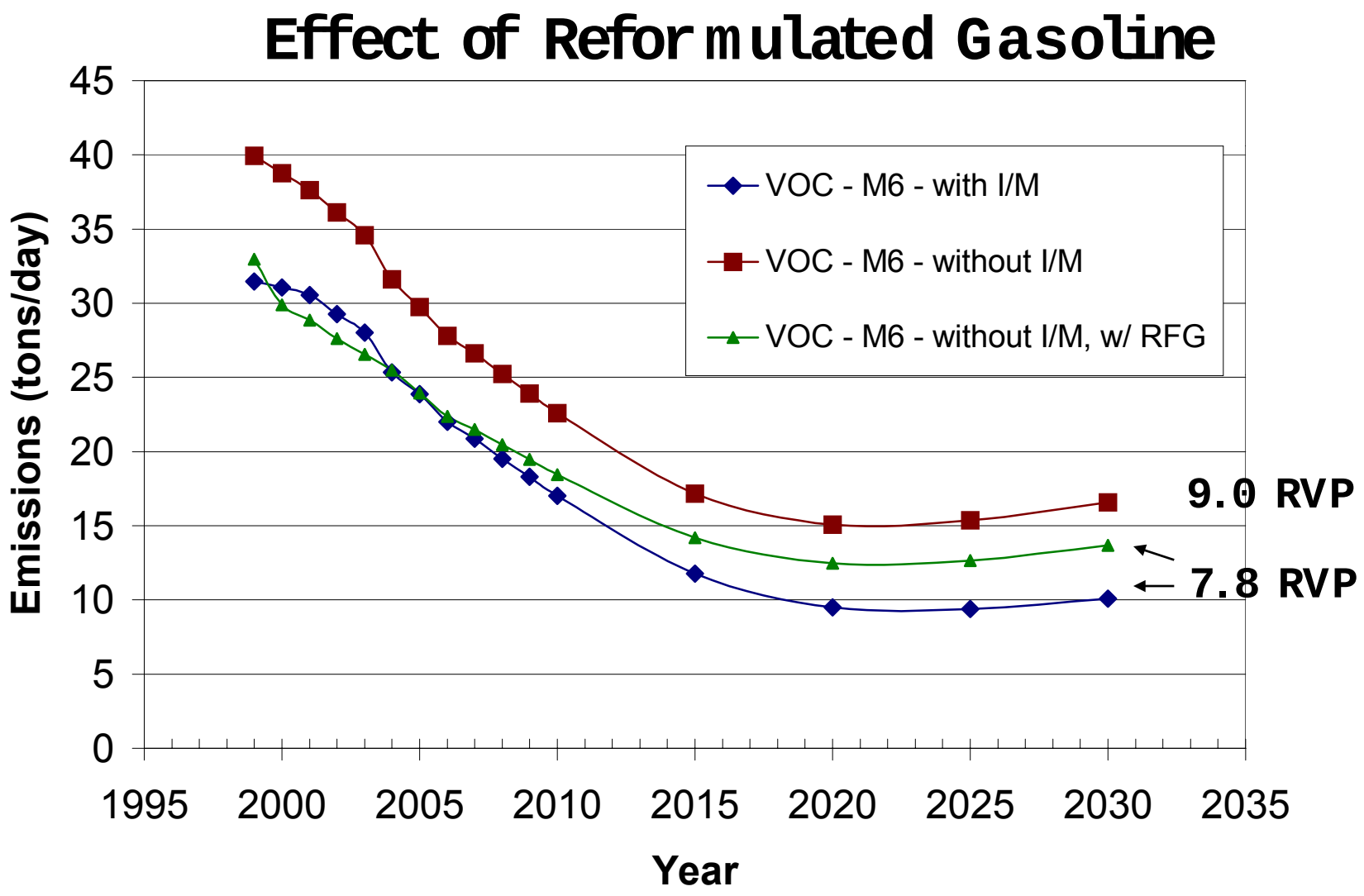
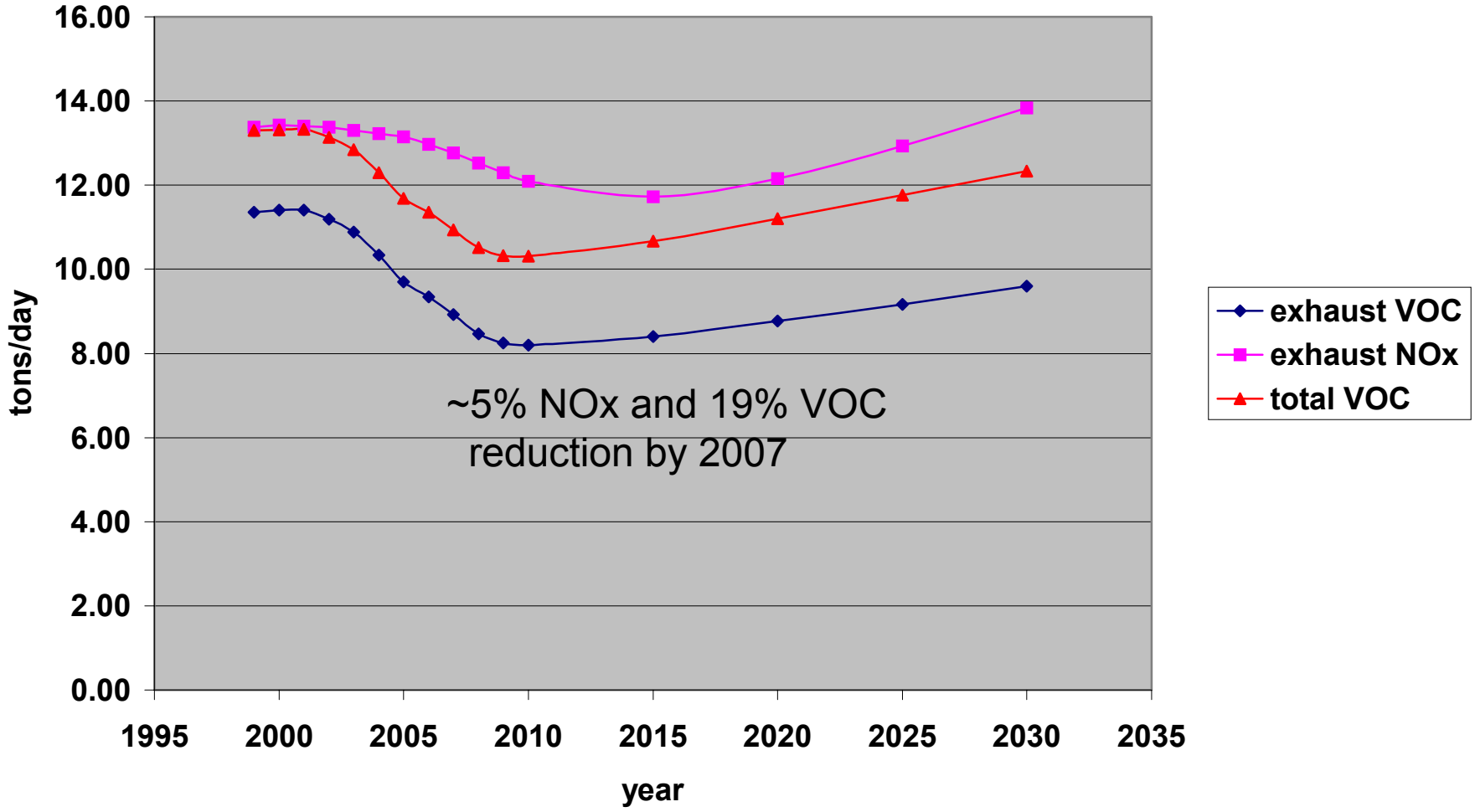


Figure 4-8. Davidson County - VOC Emissions with and without I/M Program

Davidson County Nonroad Mobile
(excl. aircraft, railroads, marine vessels)

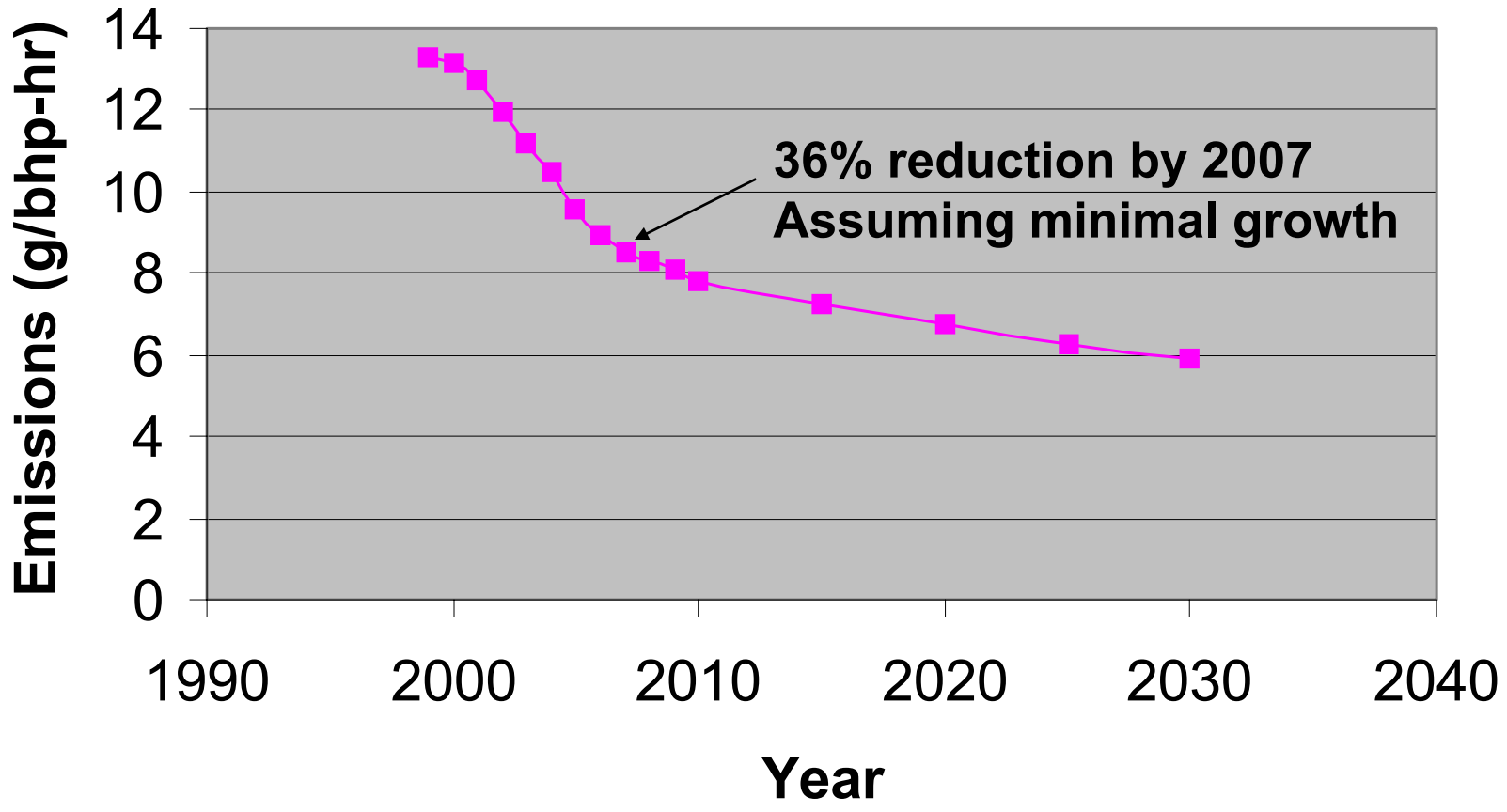


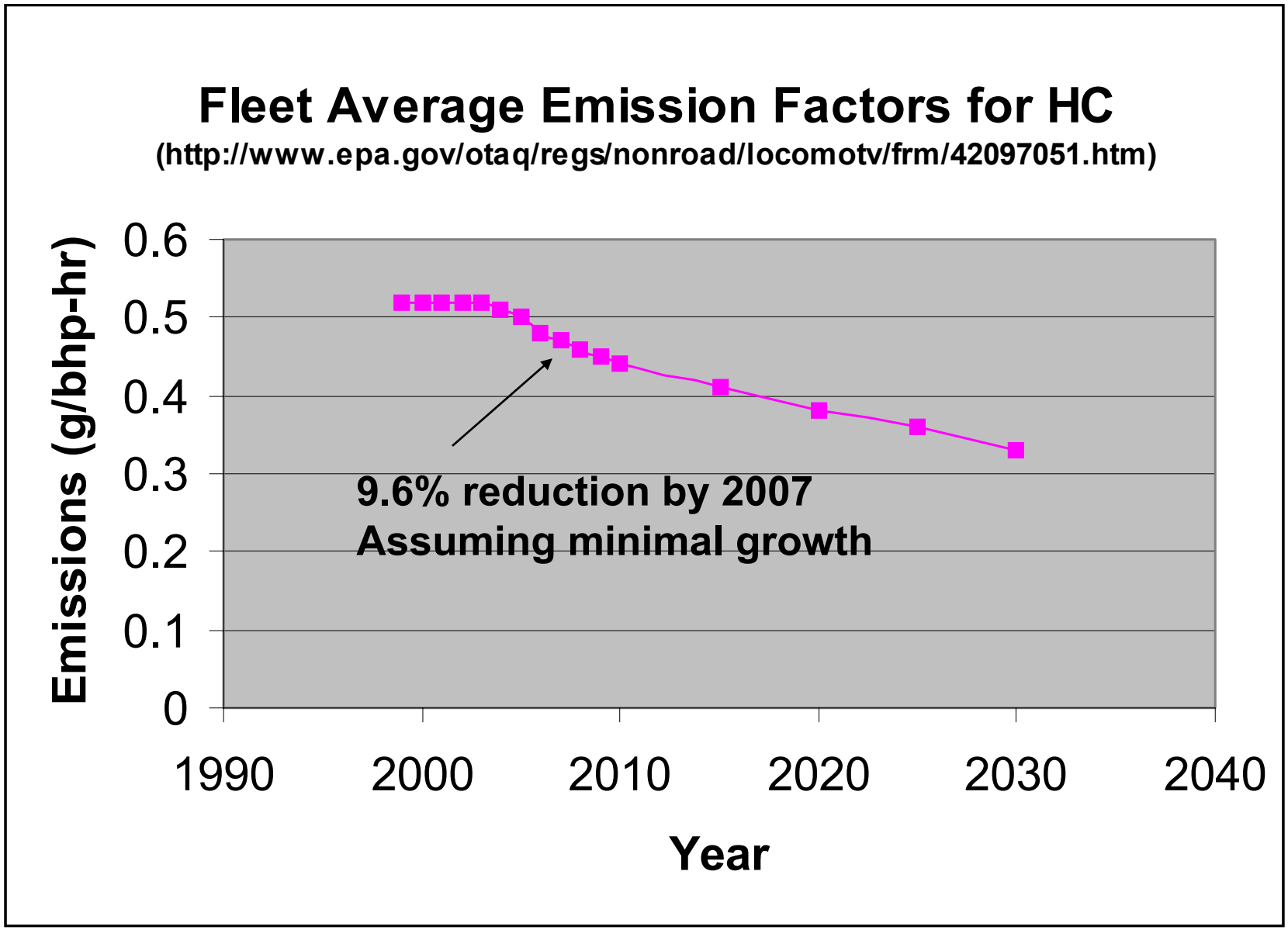
Railroad Locomotive Standards

- Exhaust standards were promulgated in 1998
- Three separate sets of standards:
  - Tier 0: locomotives manufactured 1973-2001
  - Tier 1: locomotives manufactured 2002-2004
  - Tier 2: locomotives manufactured 2005+
- NOx, HC, CO and PM standards
- Includes remanufactured locomotive engines

Fleet Average Emission Factors for NOx

(http://www.epa.gov/otaq/regs/nonroad/locomotv/frm/42097051.htm)




Fleet Average Emission Factors for HC
(http://www.epa.gov/otaq/regs/nonroad/locomotv/frm/42097051.htm)
Emissions (g/bhp-hr)
0.6
0.5
0.4
0.3
0.2
0.1
0
9.6% reduction by 2007
Assuming minimal growth
1990
2000
2010
2020
2030
2040
Year

Summary

(based on TN data, MOBILE6 and Nonroad)

- FMVCP, Fuel Standards, and Engine Standards will reduce emissions of NOx and VOCs
- On-road Mobile source emissions will decrease by 34 and 31% by 2007 and are predicted to decrease by 85 and 67% by 2025
- Non-road Mobile source emissions will decrease by 5 and 19% by 2007 but are predicted to reach a minimum by 2010-2015
- Railroad emissions will decrease by 9.6 and 36% by 2007 and continue to decrease